Effects of Quality Management Practices and Concurrent Engineering in Business Performance

Author(s): Belay, Alemu Moges; Takala, Josu; Helo, Petri; Kasie, Moges Fentahun

Title: Effects of Quality Management Practices and Concurrent Engineering in Business Performance

Year: 2011

Versio: Published version

Please cite the original version:

Belay, A.M., Takala, J., Helo, P. & Kasie, M.F. (2011). Effects of Quality Management Practices and Concurrent Engineering in Business Performance. *International journal of business and management* 6(3), 45-62. http://doi.org/10.5539/ijbm.v6n3p45

Effects of Quality Management Practices and Concurrent Engineering in Business Performance

Alemu Moges Belay
Department of production, University of Vaasa
Pobox 700, FI-65101, Vaasa, Finland
E-mail: albel@uwasa.fi

Petri Helo & Josu Takala
Department of production, University of Vaasa, Vaasa, Finland
E-mail: albel@uwasa.fi; phelo@uwasa.fi; jot@uwasa.fi

Fentahun Moges Kasie
Department of mechanical & Industrial Engineering, Institute of technology
Hawassa University Hawassa, Ethiopia
E-mail: fentahunmk@gmail.com

Abstract

The main focus of this paper is to indicate the effect of quality management practices and concurrent engineering on business performance improvement. The research has been done by taking one of Brewery Company (Meta Abo Brewery S. Co) as a case study. Practical secondary data have been collected and analyzed to understand what it seems the actual company's business results growth rate in terms of annual sales, profit before income tax, production volume and costs of production. These results are compared to the ideal continuous improvement organization business results. Primary data are also analyzed to test quality practice levels of the company. The results of these discussions approve that there exists a direct relationship between TQM & CE, and company's business performance improvement. Finally, proposed business improvement model and modified TQM & CE implementation models are presented.

Keywords: Total quality management, TQM, Concurrent engineering, CE, Business performance, Performance improvement

1. Introduction

The quality concept has developed over the last few decades to become a broad management tool as opposed to its initial role of control. Total Quality Management (TQM) and productivity have become major concerns of business managers seeking to maintain or increase competitive advantage. At present dynamic manufacturing environment, where quality is vital to success, manufacturers use TQM as a tool to substantially improve productivity and customer satisfaction. Based on an extensive study of previous research on TQM, six core values of TQM were identified as critical for successful TQM implementation. These values of TQM are functioning as litmus paper to test the current quality status of the firms. These values are top management commitment, everybody's commitment, continuous improvement, focus on customer, focus on process, and using a scientific approach for decision making.

The core values of TQM that have been listed above represent how to encourage and motivate the employees to the best way to improve their capabilities, skilled, commitment and productive by giving them relevant information, power, knowledge, and rewards. So logically, the significant expected effect of the TQM principles will be on the firm's overall business results. Besides, most of the previous studies point out that productivity is one of the measure business performances directly affected by application of the TQM principles (Morris, 1993). This means that the adoption of TQM concepts leads to inspiring employees to succeed and grow, then improving their performance and productivity (Oakland, 1993). Most of developing countries' enterprises like brewery, textile, sugar, flour, & other Agro–processing industries are very low in their productivity as compared

to other developing & developed nations as mentioned on UNIDO, Vienna, 2004. There should be a change, representing nothing short of breakthrough for those organizations to halt productivity decline. Such a change can be brought through management styles like TQM and CE.

To achieve a significant result on business performance improvement in the existing dynamic market, using or combining more than one process improvement approaches for the betterment of the company's business performance may require. According to Najmi M., and Ip-Shing F., (2002), the process approach at the heart of TQM is fundamental to embedding CE in new product development and application of CE through TQM is illustrated practically in industries. This paper presents the improvement signals in the case company by linking CE into TQM initiatives that support the recent empirical research by Sun, H. and Zhoa, Y., (2010) that show a positive relationship between TQM and fast NPD.

This study is organized in the following order. The second section will briefly explains the literature reviews and asses related researches and theories. The third section dealt with the methodologies used while doing this research and followed by explanation of the commonality between TQM and concurrent engineering in the fourth section. The Fifth part comes with data, result discussions and proposed model for the implementation of TQM that is linked with CE and finally the conclusion and recommendations are presented on the sixth section.

2. Literature

TQM has been widely considered as management tool for business stability, growth and prosperity (Issac et al., 2004), as a tool to keep competitive advantage (Kuei et al., (2001), and Eng and Yusof (2003)). Many literatures show that different quality practices enhance firms' performance in many aspects like on early design involvement (concurrent engineering), reduction costs, focusing on prevention techniques and improving management (Crosby, 1979, 1984; Deming, 1982, 1986; Garvin, 1984, 1988; Juran, 1982, 1989). Kanji et al., (1992) indicated that quality as a core variable for strategic advantage in the operations function and on the competitiveness of the firm. Garvin (1996) specifically showed the relationship between quality improvement and profitability with consistency on production and marketing.

For last two decades, quality has been considered as one of important factor in manufacturing, service and purchasing to increase sales and profits this is supported by several literatures (Aaker and Jacobson (1994), Anderson et al. (1994), Buzzell et al. (1975), Capon et al. (1990), Craig and Douglas (1982), Farris and Reibstein (1979), Jacobson and Aaker (1987), McGuire et al. (1990) and Phillips et al. (1983). TQM also has been seen as a method of reducing costs (Crosby 1987 and Dale and Plunkett 1995). Substantial studies dealt with the relationship between companies' performance and quality improvement, Adam (1994), Adam et al. (1997) , Flynn et al. (1995), Forker (1997), Ittner and Larcker (1997). Empirical study has been done by Madu et al. (1996) on the linkage between organizational performance and quality management, and they presented the measures as profitability, sales growth, competitiveness, productivity, profit growth, cost and market share. The direct relationship between TQM and organizational performance also further studied by (Huarng and Chen, 2002; Li and Collier, 2000; Wilson and Collier, 2000; Madu, 2000; Sun, 2000; Terziovski and Samson, 1999)

TQM and its financial effect has been studied by several authors, Hendricks and Singhal (1996, 1997, 2001a, 2001b), and also the general performance improvement after implementation of TQM studied by Easton and Jarrell (1998). Schafferand Thompson (1992), Opara (1996), and Agus and Hassan (2000) have indicated that the positive relationship between Total Quality Management and financial performance & overall performance. According to (Corbett et al., 2005) careful design and implementation of consistent and documented quality management systems can contribute significantly to superior financial performance

A single approach cannot be expected to bring a significant effect on every dimension while measuring organizational performance (Walker and Ruekert, 1987). This forces many firms to operationalized organizational performance in to different segments of measurements like sales growth, return on assets, new product success , market share and overall performance (Slater and Narver (1994), Narver and Slater, (1990), (Jaworski and Kohli, 1993). Since the 1980s TQM has been used as a competitive weapon for many firms success (Kuei et al., 2001), but some authors warn and show its ineffectiveness and inefficiency (Mani et al., (2003);Waddell andMallen (2001); Choi and Eboch (1998); Chandler, (2000); Dale et al., (1998), Lemak et al., (1997); Reed et al., (1996); Broetzmann et al., (1995); Neal and Tromley, 1995). Following that, a number of literature also indicate the failure of quality management that can be directed to the difficulty of converting TQM concepts into practice (Hafeez, Malak, & Abdelmeguid, 2006)

TQM can be considered as the driver for the integration engineering and manufacturing functions into CE and CE becomes an enabling technology for TQM. Further, disciplines such as Reliability, Maintainability, and CAD become the enabling technologies for CE (Poeth, D.F 1990). He also stated that firms can use TQM as the

vehicle for introduction of CE into the NPD processes. The overall philosophy of concurrent engineering is single, but powerful, principle that enhances the incorporation of downstream issues into the upstream phases of a development process. Consequently it shortens product development times, improved product quality, and lower development– production costs (Yassine, A & Braha, D., (2003)). Hongyi Sun, Yangyang Zhao and Hon Keung Yau (2009) investigated the influence of quality management on the speed of NPD and compared concurrent engineering (CE) and TQM that leads to several common principles. For instance value analysis, QFD and team work are some of the common items that have direct relationship between CE and TQM. Karbhari, V.M, et.al (1994) stated as team or team building is the first necessary ingredient to good concurrent engineering solutions. Parallelization, standardization and integration are the three main characteristics of a CE-oriented product development process, Bullinger and Warschat (1995). According to Sun, H. and Zhoa, Y., (2010) companies which have implemented TQM and other quality tools will have a better basis for implementing new NPD approaches (CE and DFMA). Najmi M., and Ip-Shing F., (2002) stated the possibility of CE characteristics to be incorporated in TQM approach and particularly ISO9000:2000 standard. Martin Marietta's Space System's programs have used the TQM concepts like CE, vendor involvement, product teams, and continuous product improvement while building and designing structural subsystems.

3. Methodology

This paper has been done using both quantitative and qualitative research approaches. Quantitative methods were formal data collection techniques about the existing business performances and total quality management practices in the company. The qualitative approaches were also used to perform open interviews & to make some other subjective decisions with concerned persons. The entire data were collected in two phases. The first phase was carried out during 2006/07 and the second one was performed during 2009/10. Its aim was to understand in depth the effect of TQM & CE before & after their partial implementation. Data were collected with various data collection methods to obtain relevant information concerning company's overall business results and TQM practices. These data gathering methods were:

(1) ***Records and Documentation*****:** secondary data were collected from company's documentation & historical records. The past eight-year's business performances were obtained from company's accomplishment reports.

(2) ***Questionnaire Survey*****:** it was done by preparing questionnaires and distributing them to concerned personnel to assess the existing situations regarding to quality practices within the firm using Crosby's quality management maturity matrix. It was distributed to 35 employees at supervisory level and above. The purpose of this standard questionnaire survey was to indicate the company's quality maturity level on five quality dimensions such as management understanding & attitude, problem handling techniques, continuous improvement actions, quality organization status, and summation of company's position.

(3) ***Interviews:*** this was conducted by asking open oral and written questions to concerned persons in the firm. All interviews were carried out with face-to-face discussion with QMS representative and other interviewees from quality, production, and technical departments.

4. Total quality management and concurrent engineering

According to Sun, H. and Zhoa, Y., (2010) and Sun, H. et.al (2009) companies which have implemented TQM and other quality tools will have a better basis for implementing new NPD approaches (CE and DFMA). In this research, it has been also stated that the positive relationship between TQM and fast NPD and common factors between them are characterized (see figure 1). This is also supported by (Poeth, D.F 1990) on the idea of TQM as an initiative for product and performance improvements with the incorporation of all necessary tools in CE. Najmi M., and Ip-Shing F., (2002) stated the possibility of CE characteristics to be incorporated in TQM approach and particularly ISO9000:2000 standard. CE and QFD techniques can be applied together to provide an extended design team with valuable, shared information throughout the design process (Harding, Omar and Popplewell, 1999). QFD fits ideally as a "front-end" process to concurrent engineering (Jarvis, 1999)

Insert figure 1 here

Concurrent engineering requires maximized timely relevant design information throughout all stakeholders of product development processes especially at initial stage. (Tucker & Hackney, 2000) stated that CE offers a different approach to new product introduction in which the requirements of all functions, especially customers are discussed and at the conceptual design stage that keeps predetermined lead times and costs of new product introduction are minimized that cannot be happened in sequential engineering. Gunasekaran, A, (1998) has proposed an integrated product development-quality management (IPD-QM) to support manufacturing organizations proactively measure, utilize, and improve product development and production processes to

manufacture high-quality products. The goal of an IPD-QM system is to deploy effective management principles of TQM and CE to develop products and manage upstream and downstream operations con-currently.

5. Data analysis and results discussion

Business Performance: The Company's consecutive five-years (2001-2006) financial and productivity related performance results are shown as below in table 1; and their annual growth rates have also been calculated as results indicated in table 2. Table 3 indicates costs and productivity of labor, energy and equipment maintenance components of the firm. These results were found during first phase of data collection period (2006/07).

Insert table 1 here

Insert table 2 here

Insert table 3 here

Insert figure 2 here

Insert figure 3 here

Insert figure 4 here

Table 2 and figure 3 indicate firm's annual percentage growth rates of production volume, & sales have been improved except the year 2002/03. But the annual growth rate of production costs is higher than that of sales & production. Due to this reason, profitability and productivity growth rates were decreasing; it provides an alarming signal for the company to undertake crucial activities in order to survive in future market. The mean values of profit and total productivity growth rates for the year 2001-2006 were negative (-1.616 & -2.899) respectively.

Moreover, table 3 & figure 2 indicate that productivity of direct labor and energy were decreasing continuously (with average -46% and -44% respectively). But the costs have been raised in average with around 85% & 99% in the indicated budget years. From the above results, it is clearly seen that: "the organization was undergoing in declining productivity and profitability in contradiction to continuous improvement."

Quality Practice: During first phase (2006/07), thirty-five employees at supervisory level and above were requested to provide their opinion on current situation of their company depending on given quality criteria. The rating criteria and quality dimensions were adapted from Crosby's Quality Management Matrix. The results from respondents are as shown below and the details of survey questionnaire are presented in annex part A.

Insert table 4 here

Insert figure 5 here

The above table 4 and figure 5 reveal that the quality maturity level of the organization was very low in general (with mean value of 2.829 out of 5). Especially it was suffering with lack of proper problem handling at early their development stages and quality improvement actions. These results were indicating additional evidence that the duties of quality control/ management were reporting all quality appraisals to top management with minimum actions on defect prevention, problem handling at early stage and continual improvement. This was also another signal that authority was centralized on the hands of top management and management teams. But, in this globalization and competitive market environment, thinking towards profitability and productivity improvement without focusing on quality improvement tools and techniques is too much incredible.

TQM assessment was also conducted in the firm basically using Simplified Business Excellence Model that its criteria and their weight allocation has been adopted from European Foundation for Quality Management (EFQM) to obtain more concrete information on the depth quality management level. This assessment was performed through interviews from concerned departments like quality, production, maintenance, marketing, and administration. The main considerations that have been taken during assessment of each TQM dimensions are summarized on table 5 and figure 6.

In general the firm's achievement in nine TQM dimensions was very low i.e. its average achievement was only about 32%. The results on this assessment were providing large evidence on TQM practices

1. Management teams were only responsible for improvement; and the role of employees, customers, suppliers and other stakeholders involvement were neglected;
2. Strategic plans focused on short-term financial targets; vision, missions and objectives were not clear to stakeholders;
3. Training, appraisal schemes and staffs morale were unsatisfactory;

4. Decision making based on facts and waste management was very low;
5. Customer and employee satisfaction survey were limited and are not much important to set strategic plans;
6. Culture of continuous improvement and benchmarking "best in class" were unimaginable.

5.1 Relationship between Business Results and Quality Practice (for first Phase):

Business performance results of the firm indicate that it was working to in contradiction to continuous improvement specifically on its profit and productivity growth. On the other hand, quality practices and quality maturity levels were low. The outputs from quality maturity matrix provided us good evidence; there were challenges in problem handling and continuous improvement actions. But, cost of production was continuously increasing in a higher rate than other performance indicators. These results were justifying Deming's quality philosophy that: "low quality means high costs" and "poor quality lowers productivity" (Deming, 1986).

Proposal of quality improvement model: Based on the results that have been obtained of this paper, the writers have developed two conceptual models (figure 8&9). The first model indicates model is to show the general TQM implementation steps and the second one shows how TQM improves productivity and profitability of the firm.

5.2 Key activities and performance improvements on the year 2007-2009 (during second phase)

Researchers visited the company during fiscal year of 2009/10 to observe improvements in quality related activities and the entire business performance results. They identified the following key activities in relation to quality practices.

1. **Quality Training**: Different training have been conducted at various levels to enhance workers know how about quality. Especially Chemists were under continuous training about statistical control charts.
2. **Top management Commitment and Involvement**: Top management is committed to implement various tools of quality. At the moment the company is certified ISO 14000: 2000 and ISO 9001:2000 and the company exhaustively working to renew these certificates. Different sections of the company also using different statistical process control charts (e.g. p-chart, n-chart, pn-chart, u- chart and capability indexes) on different operations. Now they are focusing on critical processes and making decisions based on facts.
3. **Employee Involvement:** Employees at different level are participating at various quality teams i.e. they are practicing the concept of quality circle.
4. **Customer Focus:** at the moment in the strategic plan of the company, indicators regarding customer complaints/satisfaction and market share have been incorporated. Based on the feedbacks and need of the customers the company has developed one new product (Meta Premium) and changed the shape of bottles to be suitable for consumers.
5. **Concurrent engineering initiatives**: So as to be successful in concurrent engineering, cross-functional design teams, along with their associated data from different functions, must be brought together. Abdalla, (1999) indicated that the vital step towards implementing CE is to have effective cross-functional teams, which integrate the development process using both organizational and information management methods. The conceptual model for concurrent engineering with or without sophisticated IT involvement is represented on figure 7, and the firm built multi-disciplinary team for fast product delivery.

Insert figure 7 here

Though consistence and progressive performance improvement is challenging in the existing dynamic market, the general trend from the result of quality management practices and concurrent engineering practice of the case company shows a positive relationship with business performance improvement (see table 6).

6. Conclusion

At present unstable and globalization markets, companies without setting their targets to continuous improvement in wide spectrum of business directions will face difficulties to compete and exist on the current turbulent business environment. Traditional manufacturing views business results like productivity and profitability are considered as they have inverse relationship with quality i.e. increasing quality means incurring high costs of production and reduce profitability and productivity. But this paper indicates the reverse of these traditional attitudes & thoughts. To conduct this research different methodology has been used like analyzing Crosby's Quality Management Matrix, interviews and considering the historical records of firm's performance since 2001. Business performance of a case company was also analyzed with respect to different quality

dimensions and performance measurement techniques like production volume, sales, production cost, profit and productivity that is presented on table 2.

The results of this research paper shows that low quality means high costs; and companies without continuous improvement philosophies may not improve their business performance in long-term. Since the basement of continuous improvement is TQM, thinking towards improvement of business performance without TQM and related change practices are challenging and awkward. The firm's performance before quality management initiatives and concurrent engineering (in the year 2001-2006) were contradicting with the basic principle of continuous improvement due to the deficit of quality practices in the production processes. Hence, from the paper it has been concluded that QM practices improve overall business performance by:

- Reducing operation costs and increasing resource utilization by eliminating problems at their sources before they cause big damages in the business process;
- Motivating workers to do things right first time; and
- Increasing employees' skill, capability and productivity with providing necessary training & education.

As ReVelle, J.B., (2004) indicated, no single approach has capable of solving every organizational problem. The positive performance change which is achieved from year 2007-2009 indicate that if the quality management initiative is linked by concurrent engineering (CE), it leads to a better result in general (see table 6.). This in turn leads to further improvements of business performance with related approaches (e.g. BPR & etc.).

Some challenges that probably hinder the improvement processes have been observed from the case study. For instance, waiting the quality problems until they reach the final stage (testing inspections); commitment on delegation to encourage decision making (taking action rather than reporting appraisals) training and fair motivational skim and widening continuous improvement horizon throughout the company for consistent long term benefit.

References

Aaker, D., and Jacobson, R. (1994). The financial information content of perceived quality. *Journal of Marketing Research*, 31(2), 191-201.

Adam, E. E. JR. (1994). Alternative quality improvement practices and organization performance. *Journal of Operations Management*, 12(1), 27 44.

Adam, E. E. JR., Corbett, L. M., FloresS, B. E., Harrison, N. J., Lee, T. S., Rho, B., Ribera, J., Samson, D., and Westbrook, R. (1997). An international study of quality improvement approach and firm performance. *International Journal of Operations and Production Management*, 17(9), 842 873.

Agus A., and Za'faran H. (2000). Exploring the Relationship between the Length of TQM Adoption and Financial Performance: An Empirical Study in Malaysia. *International Journal of Management*, September, Vol 17 No 3, pp 323-333

Anderson, E.W., Fornell, C., and Lehmann, D. R. (1994). Customer satisfaction, market share, and profitability: findings from Sweden. *Journal of Marketing*, 58(3), 53-66.

Bergman, B., & Klefsjö, B. (2003). *Quality from Customer Needs to Customer Satisfaction*, (2nd Ed.), Lund: Studentlitteratur.

Brocka , Bruce and M. Suzanne. (1992). *Quality Management: implementing the best ideas of the masters.* New York: McGraw Hill.

Broetzmann, S.M., Kemp, J., Rossano, M., & Marwaha, J. (1995). Customer satisfaction- lip service or management tool?. *Managing Service Quality*, 5, pp. 13–18.

Buzzell, R. D., Gale, B. T., and Sultan, R. G.M. (1975). Market share a key to profitability. *Harvard Business Review*, 53(1), 97-106.

Capon, N., Farley, J. U., and Hoeing, S. (1990). Determinants of financial performance: a meta-analysis. *Management Science*, 36(10), 1143-1159.

Chandler, G.N. (2000). Human resource management, TQM and firm performance in small and medium-size enterprises. *Entrepreneurship: Theory & Practice*, 25(1), pp. 43–57.

Choi, T.Y., & Eboch, K. (1998). The TQM paradox: Relations among TQM practices, plant performance, and customer satisfaction. *Journal of Operations Managemen*t, 17, pp. 59–75.

Corbett, C.J., Montes-Sancho, M.J., & Kirsch, D.K. (2005). The financial impact of ISO 9000 certification in the United States: an empirical analysis. *Management Science*, 51(7), pp. 1046-1059.

Craig, C.S., and Douglass, S.P. (1982). Strategic factors associated with market and financial performance. *Quarterly Review of Economics and Business*, 22(2), 101-112.

Crosby, P. B. (1987). *Quality Is Free. The Art of Making Quality Certain.* New York: McGraw-Hill.

Crosby, P.B. (1979). *Quality is Free.* New York, New American Library.

Crosby, P.B. (1984). *Quality without Tears*. New York, McGraw-Hill.

Dahlgaard, J. J., Kristensen, K., & Kanji, G. K. (1998). *Fundamentals of Total Quality Management: Process Analysis and Improvement.* London: Chapman & Hall.

Dale, B., Boaden, R., Wilcox, R., & McQuarter, W. (1998). The use of quality management techniques and tools: an examination of some key issues. *International Journal of Technology Management*, 16, pp. 305-325.

Dale, B.G. (2003). *Managing Quality*, (4th Ed.). Malden: Blackwell.

Dale, B.G., and Plunkett, J. J. (1995). *Quality Costing*. London: Chapman & Hall.

Deming, W. E. (1994). *The New Economics for Industry, Government, Education*, 2nd Ed.. Cambridge: Massachusetts Institute of Technology Center for Advanced Engineering Study.

Deming, W.E. (1982). *Quality, Productivity and Competitive Position.* Cambridge, MA, Massachusetts Institute of Technology.

Deming, W.E. (1986). *Out of the Crisis*. Cambridge, MA, Center for Advanced Engineering Study.

Eng, E.Q., & Yusof, S.M. (2003). A survey of TQM practices in the Malaysian electrical and electronic industry. *Total Quality Management*, 14(1), pp. 63-77.

Farris, P.W., and Reibstein, D.J. (1979). How prices, ad expenditures, and profits are linked. *Harvard Business Review*, 57(6), 173-184.

Flynn, B. B., Schroeder, R.G., and Sakakibara, S. (1994). A framework for quality management research and an associated measurement instrument. *Journal of Operations Management*, 11, 339-366; 1995, The impact of quality management practices on performance and competitive advantage. *Decision Sciences*, 26(5), 659-691.

Forker, L. B. (1997). Factors affecting supplier quality performance. *Journal of Operations Management*, 15(4), 243 269.

Garvin, D.A. (1984). What does product quality really mean?. *Sloan Management*, Fall.

Garvin, D.A. (1988). *Managing Quality*. New York, The Free Press.

Garvin, David A. (December 1986). Quality Problems, Policies, and Attitudes in the U.S. and Japan: An Exploratory Study. *Academy of Management Journal.*

Goetsch, D.L, and Davis, S.B. (1997). *Introduction to Total Quality: Quality Management for Production, Processing, and Services*, 2nd Ed.. New Jersey, USA: Prentice-Hall Int., Inc.

Gunasekaran, A. (1998). An integrated product development-quality management system for manufacturing. *The TQM Magazine*, Volume 10, Number 2, pp. 115–123

Hafeez, K., Malak, N., & Abdelmeguid, H. (2006). A framework for TQM to achieve business excellence. *Total Quality Management*, 17(9), 1213–1229.

Harding, J.A., Omar, A.R., and Popplewell, K. (1999). Applications of QFD within a concurrent engineering environment. *International Journal of Agile Management Systems*, Vol. 1 Iss: 2, pp.88 - 98

Hellsten, U., & Klefsjö, B. (2000). TQM as a Management System Consisting Of Values, Techniques and Tools. *The TQM Magazine*, 12(4), 238-244.

Huarng, F., & Chen, Y.T. (2002). Relationships of TQM philosophy, methods and performance: a survey in Taiwan. *Industrial Management & Data Systems*, 102(4), pp. 226–234.

Issac, G., Rajendran, C., & Anantharaman, R.N. (2004). A conceptual framework for total quality management in software organizations. *Total Quality Management*, 15(3), pp. 307-344.

Ittner, C. D., and Larcker, D. (1997). The performance effects of process management techniques. *Management Science*, 43(4), 522-534.

Jacobson, R., and Aaker, D. A. (1987). The strategic role of product quality. *Journal of Marketing*, 51(4), 31-44.

Jarvis, M. (1999). Concurrent Engineering. *Work Study*, Vol. 48, No. 3, pp 88-91.

Jaworski, B.J., & Kohli, A.K. (1993). Market orientation: antecedents and consequences. *Journal of Marketing*, 57, pp. 53–70.

Juran, J.M. (1982). *Juran on Quality Improvement.* New York, Juran Institute.

Juran, J.M. (1989). *Juran on Leadership for Quality.* New York, Juran Institute.

Kanji I, G.K., Kristensen, K.K., & Dahlgaard, J.J. (1992). Total quality management as a strategic variable. *Total Quality Management*, 3, pp. 3-8.

Karbhari, V.M, et.al. (1994). Total Quality Design: An Approach for Customer Satisfaction in Critical Advanced Technologies. *Benchmarking for Quality Management & Technology*, Vol. 1, No. 1, 1994, pp. 65-88.

Kotter, J. P. (1996). *Leading Change. Boston.* Harvard Business School Press.

Kuei, C., Madu, C. N., & Lin, C. (2001). The relationship between supply chain quality management practices and organizational performance. *International Journal of Quality & Reliability Management*, 16(8), pp. 864-872.

Kuei, C., Madu, C.N., & Lin, C. (2001). The relationship between supply chain quality management practices and organizational performance. *International Journal of Quality & Reliability Management*, 16(8), pp. 864–872.

Lemak, D.J., Reed, R., & Satish, P.K. (1997). Commitment to total quality management: is there a relationship with firm performance?. *Journal of Quality Management*, 2(1), pp. 67–86.

Li, L.X., & Collier, D.A. (2000). The role of technology and quality on hospital Financial performance – an exploratory analysis. *International Journal of Service Industry Management*, 11(3), pp. 202–224.

Madu, C.N. (2000). *House of Quality (QFD) in A Minute*. Fairfield, CT: Chi Publishers.

Madu, C.N., Kuei, C., & Jacob, R. (1996). An empirical assessment of the influence of quality dimensions on organizational performance. *International Journal of Production Research*, 34(7), pp. 1943–1962.

Mani, T.P., Murugan, N., & Rajendran, C. (2003). TQM is a must for success, but not sufficient for survival: a conceptual framework as contemplated in ancient Tamil literature in India. *Total Quality Management*, 14(4), pp. 395–405.

Martin, L. L. (1993). *Total Quality Management in Human Service Organizations.* Newbury Park, Calif: Sage.

Mcguire, J.B., Schneeweis, T., and Branch, B. (1990). Perceptions of firm quality: a cause or result of firm performance. *Journal of Management*, 16(1), 167 180.

Morris, L. (1993). TQM Improves Productivity. *Training & Development*, 47 (10), pp. 74-75.

Najmi M., and Ip-Shing F. (2002). "Concurrent Engineering in Total Quality Management Environment", 8th International Conference on Concurrent Enterprising, Rome, Italy.

Narver, J.C., & Slater, S.F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing*, 54, pp. 20–35.

Neal, J.A., & Tromley, C.L. (1995). From incremental change to retrofit: creating high-performance work systems. *Academic Management Executive*, 9, pp. 42–54.

Neely, A. (1998). *Performance Measurement: Why, What and How.* Economist Books, London.

Oakland, J.S. (1993). *Total Quality Management: The Route to Improving Performance,* 2nd Ed, Oxford, UK: Butter Worth– Heinemann Ltd.

Opara Emmanuel Uzoma. (1996). The Empirical Test of Total Quality Management: AnApplication of TQM at Chevron and Its Impact on Productivity. *Quality Management Journal*, Vol 4 No 1, p 10.

Phillips, L.W., Chang, D.R., and Buzzell, R.D. (1983). Product quality, cost position and business performance: a test of some key hypotheses. *Journal of Marketing,* 47(2), 26-43.

Poeth,D.F. (1990). *Concurrent Engineering - Key to Cost-Effective Product Reliability, Maintainability, and Manufacturability.* Proceedings R&M & CAE in Concurrent Engineering Workshop.

Reed, R., Lemak, D.J., & Montgomery, J.C. (1996). Beyond process: TQM content and firm performance. *Academy of Management Review*, 21(1), pp. 173–202.

ReVelle, J.B. (2004). *Quality Essentials: A Reference Guide from A to Z.* ASQ-Quality Press. Milwaukee, WI.

Schaffer RH and H Thompson. (1992). Successful Change Programs Begin with Results. *Harvard Business Review*, September/October, pp 80–89.

Slater, S.F., & Narver, J.C. (1994). Does competitive environment moderate the market orientation performance relationship?. *Journal of Marketing*, 58, pp. 46–55.

Sun, H. (2000). Total quality management, ISO 9000 certification and performance improvement, International. *Journal of Quality & Reliability Managemen*t, 17(2), pp. 168–179.

Sun, H., and Zhoa, Y. (2010). The empirical relationship between quality management and the speed of new product development. *Total Quality Management*, Vol. 21, No. 4, 351–361.

Sun, H., Zhao, Y., and Hon Keung Yau, H.K. (2009). The relationship between quality management and the speed of new product development. *The TQM Journal*, Vol. 21 No. 6, 2009 pp. 576-588.

Terziovski, M., & Samson, D. (1999). The link between total quality management practice and organizational performance. *International Journal of Quality & Reliability Management*, 16(3), pp. 226-237.

Tucker, D., & Hackney, R. (2000). Towards the integration of concurrent engineering environments within organizational strategy. *Journal of management development*, Vol. 19, No 3, p. 179-189.

Waddell, D., & Mallen, D. (2001). Quality mangers: beyond 2000?. *Total Quality Management*, 12, pp. 373–384.

Walker, O.C., & Ruekert, R.W. (1987). Marketing's role in the implementation of business strategies: a critical review and conceptual framework. *Journal of Marketing*, 51, pp. 15–33.

Wilson, D.D., & Collier, D.A. (2000). An empirical investigation of the Malcolm Baldrige National Quality Award causal model. *Decision Science*, 31(2), pp. 361–390.

Table 1. Overall organization's business performance

Budget Year	Production volume[hl]	Sales ['000 Birr]	Production cost ['000 Birr]	Non-taxed profit['000Birr]	Total productivity
2000/01	374,281	197,236	90,417	74,293	4.14
2001/02	380,765	204,858	94,275	70,018	4.04
2002/03	373,723	199,846	90,685	64,203	4.12
2003/04	386,697	205,422	92,850	67,565	4.16
2004/05	409,628	219,075	103,290	68,521	3.97
2005/06	422,232	243,958	118,800	68,060	3.55

Table 2. Annual organization's performance growth rate

Budget Year	Production Growth (%)	Sales Growth (%)	Production Cost Growth (%)	Profit Growth (%)	Productivity Growth (%)
2001/02	1.732	3.864	4.092	-5.754	-2.431
2002/03	-1.849	-2.447	-3.959	-8.305	2.036
2003/04	3.472	2.790	2.332	5.237	1.059
2004/05	5.930	6.646	10.107	1.415	-4.777
2005/06	3.077	11.358	13.056	-0.673	-10.380
Average	**2.472**	**4.443**	**5.126**	**-1.616**	**-2.899**

Table 3. Cost and productivity of labor, energy & repairing m/cs

Year	Costs['000 Birr]			Productivity		
	Labor	Energy	Equipment	Labor	Energy	Equipment
2001/02	1409	6319	2824	270.24	60.26	134.83
2002/03	1244	7576	3858	300.42	49.33	96.87
2003/04	1557	6967	6255	248.36	55.5	61.82
2004/05	2224	10631	3337	184.19	38.53	122.75
2005/06	2600	12550	3350	162.4	33.64	126.04
Ave.% raise	**84.53**	**98.61**	**18.63**	**-45.94**	**-44.18**	**-6.52**

Table 4. Results of respondents' responses

Quality dimension	Maturity stages					Total	Mean
	1	2	3	4	5		
Management Understanding & Attitude	0	1	7	16	11	35	4.057
Quality Organization Status	2	10	22	1	0	35	2.629
Problem Handling	5	17	11	2	0	35	2.286
Quality Improvement Action	3	21	9	2	0	35	2.286
Summation of Company Position	0	7	25	3	0	35	2.886
Total	**10**	**56**	**74**	**24**	**11**	**175**	**2.829**
Average	**2**	**11.2**	**14.8**	**4.8**	**2.2**	**35**	**2.829**
% of responses	**5.71**	**32.00**	**42.29**	**13.71**	**6.29**	**100**	**2.829**

Stages 1 = Uncertainty, stages 2 = Awakening, stages 3 = Enlightenment, stages 4 = Wisdom, and stages 5 = Certainty

Table 5. Company's assessment outputs

S/N	TQM Dimensions	Wt (%)	Actual score(AS)	Wt*AS	Percent of Achievement
1	Leadership	10	3	30	60
2	Policy & strategy	8	1	8	20
3	People management	9	2	18	40
4	Resources management	9	1	9	20
5	Processes	14	1	14	20
6	Customer satisfaction	20	2	40	40
7	People satisfaction	9	2	18	40
8	Impact on society	6	4	24	80
9	Business results	15	1	15	20
10	Total achievement	100		176	35.2

Table 6. Summarized results of business performance improvement

Budget Year	Production Growth [%]	Sales Growth [%]	Return on Total Asset ROA [%]	Gross Profit Growth [%]	Productivity Growth [%]
2006/07	11.32	9.25	15.73	6.38	3.51
2007/08	20.23	21.11	18.14	8.64	2.87
2008/09	23.53	20.81	17.06	8.92	5.63

ISSN 1833-3850 E-ISSN 1833-8119

	CE for NPD	TQM for quality
Philosophy		
Customer oriented	Voice of customer	Customer focused
Parallel process	Product design and process planning	Production and quality control
Cross-functional integration	Designers, manufacturers, and marketers	Process engineers, quality engineers, and designers
External integration	Customer and suppler involvement	Customer and supplier involvement
Management support	Yes	Yes
Coordination and communication	Yes	Yes
Tools/approaches		
Teamwork	Yes	Yes
Continuous improvement (CI)	/	Yes
Quality function deployment (QFD)	Yes	Yes
Value analysis (VA)	Yes	Yes

Figure 1. Common factors in CE and TQM (Adopted from Sun, H. and Zhao, Y., (2010)

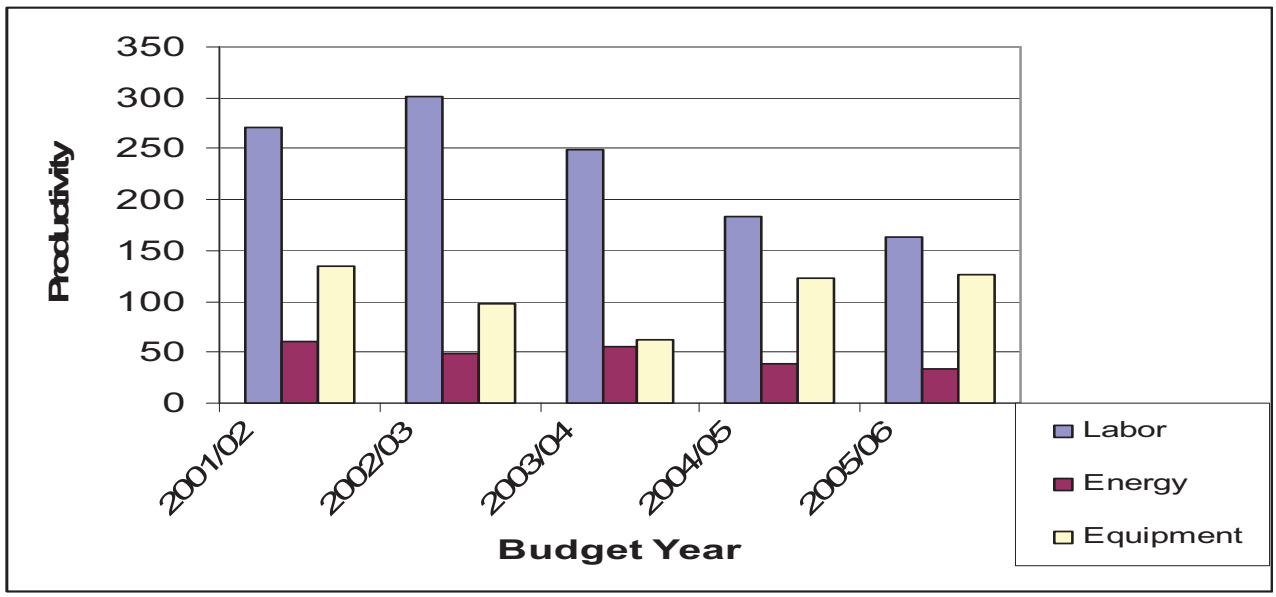

Figure 2. Productivity histogram

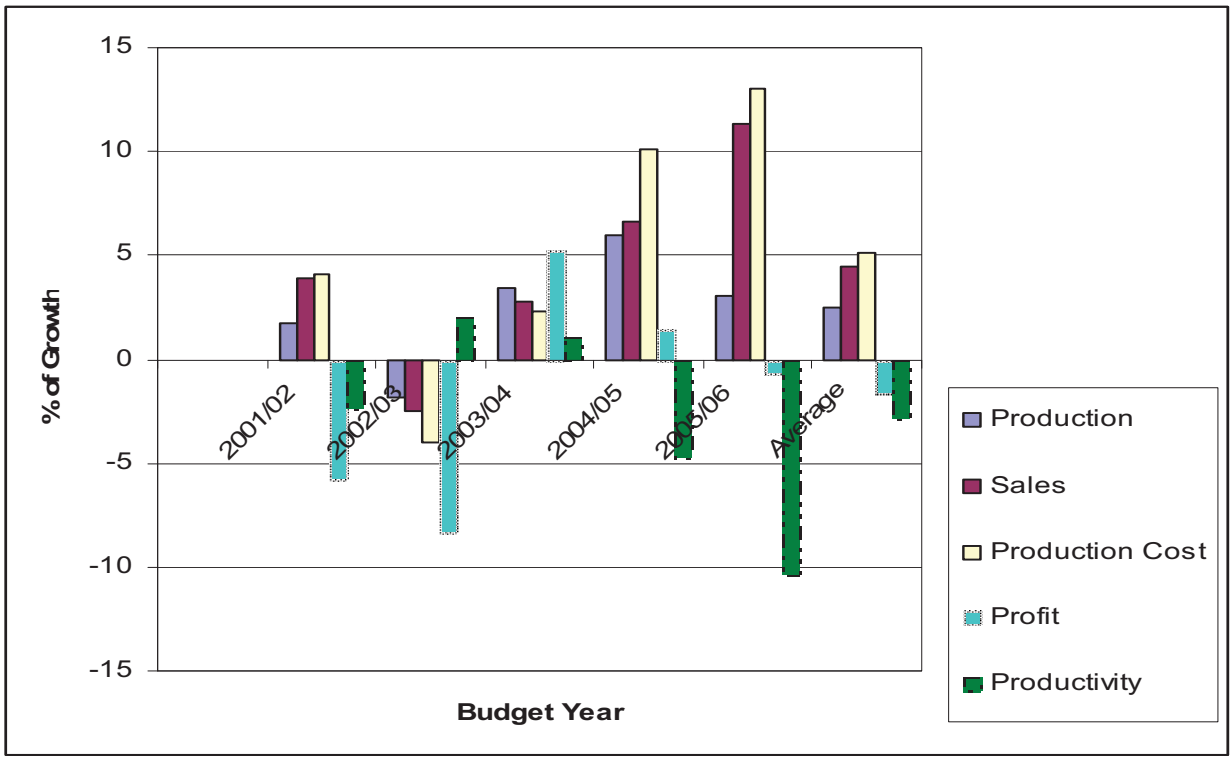

Figure 3. Company's actual business output growth

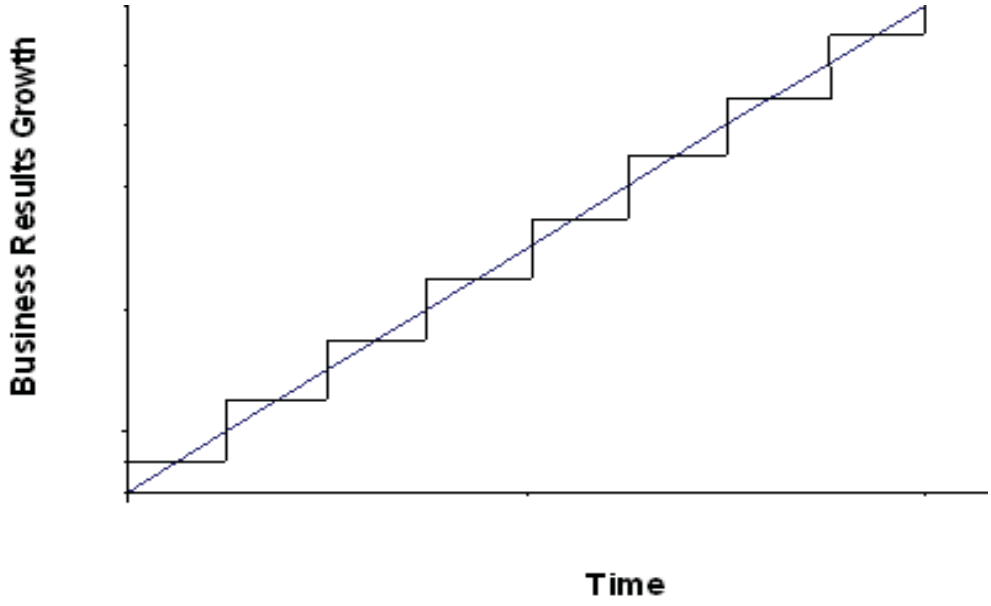

Figure 4. Business results growth in continuous improvement

ISSN 1833-3850 E-ISSN 1833-8119

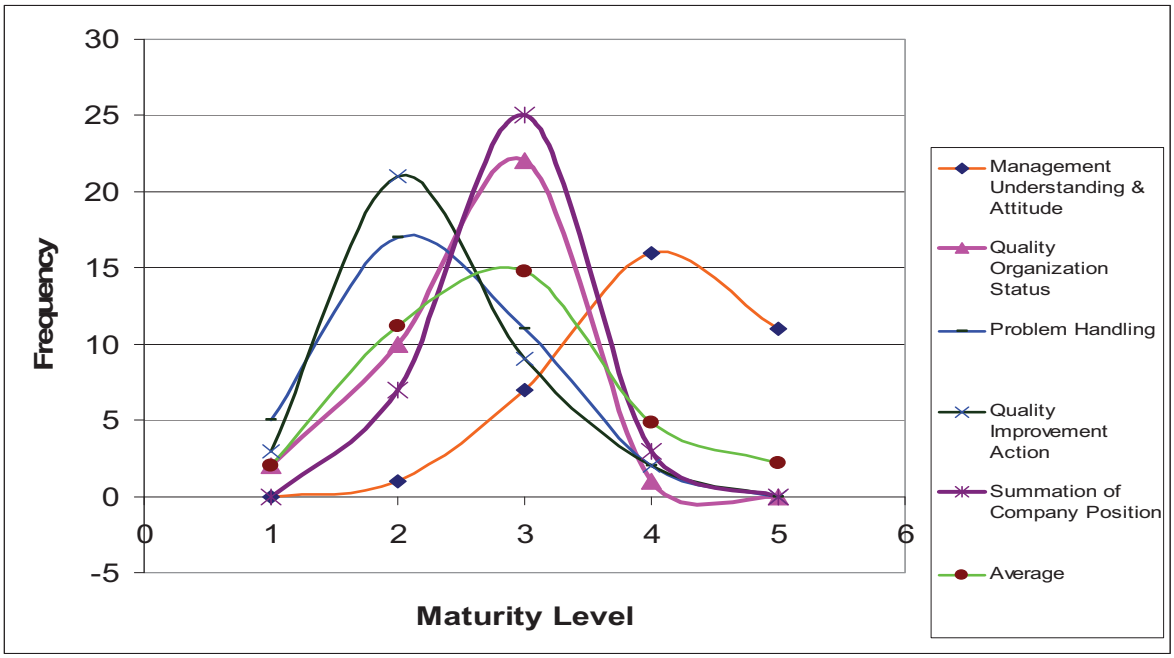

Figure 5. Quality maturity graph for five quality dimensions

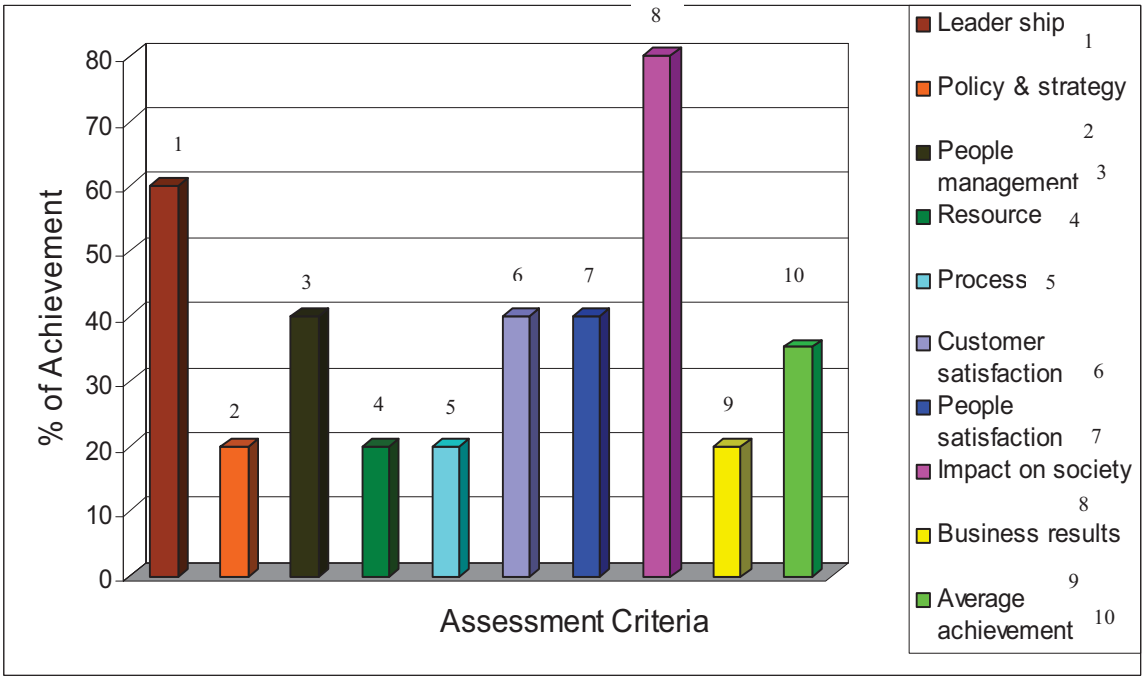

Figure 6. TQM assessment results chart

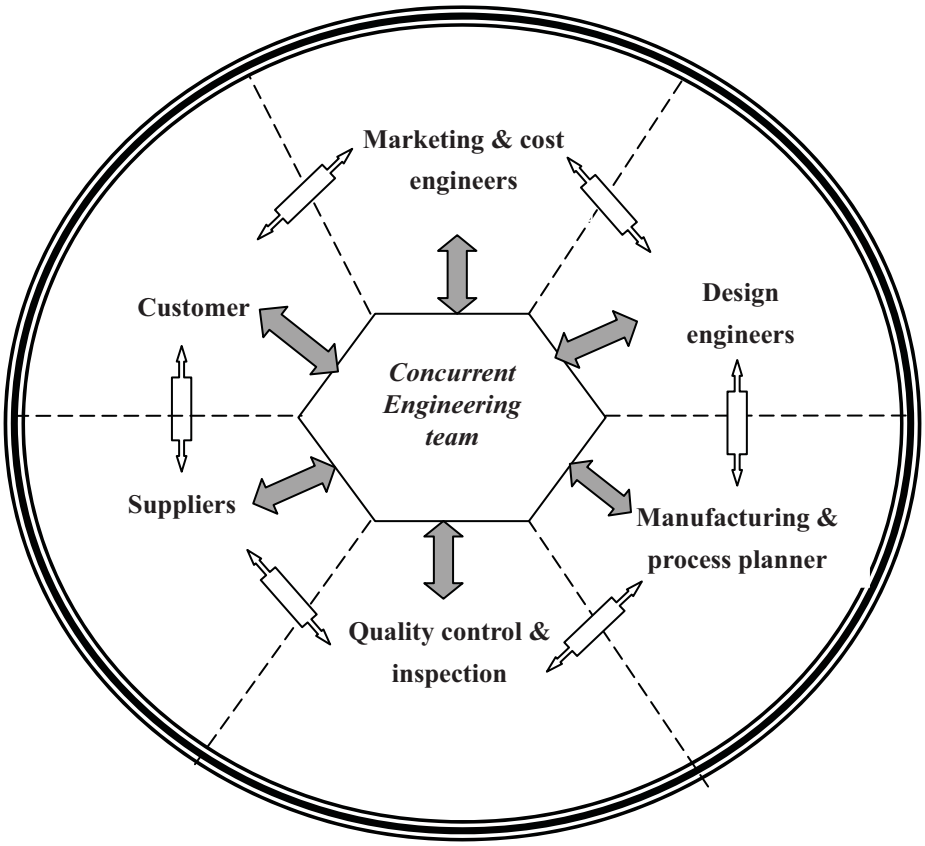

Figure 7. Concurrent Engineering/cross functional team information flow

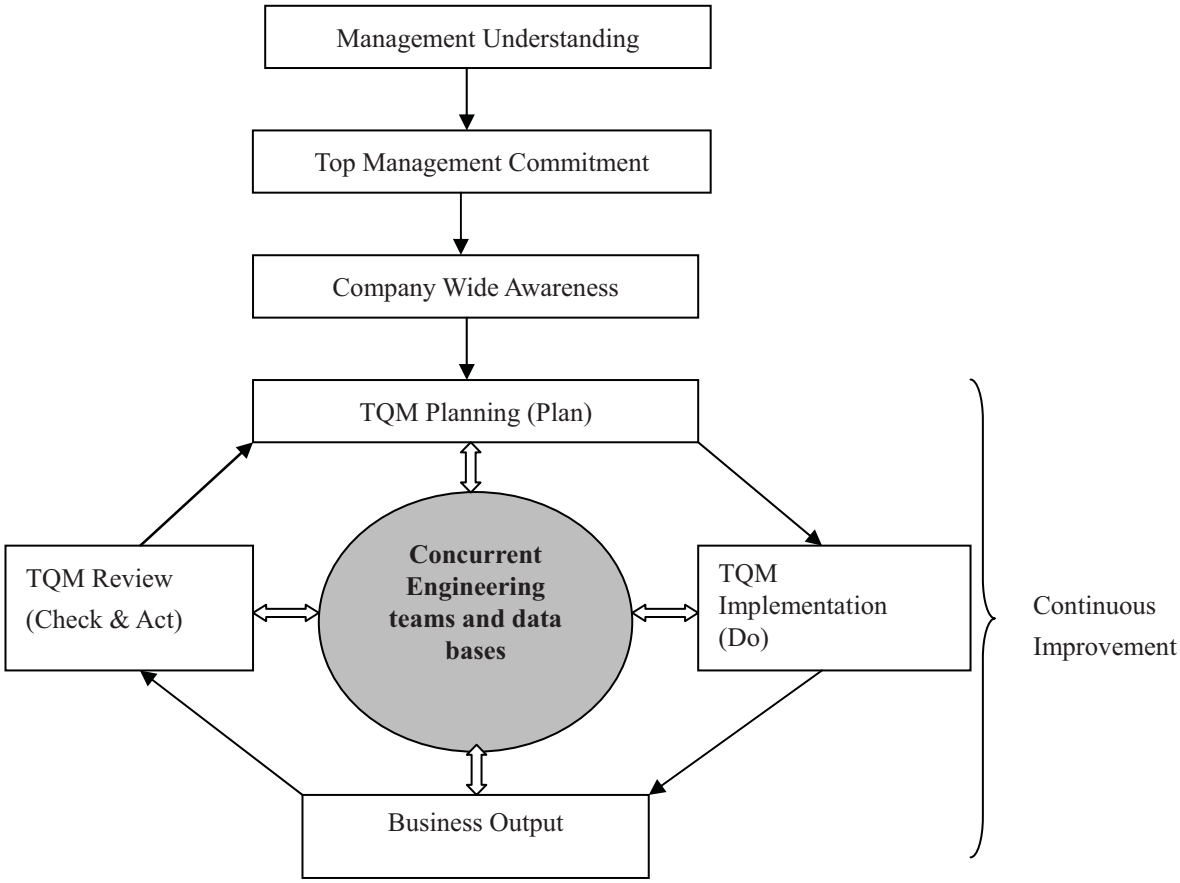

Figure 8. Modified and proposed general TQM Implementation Model

ISSN 1833-3850 E-ISSN 1833-8119

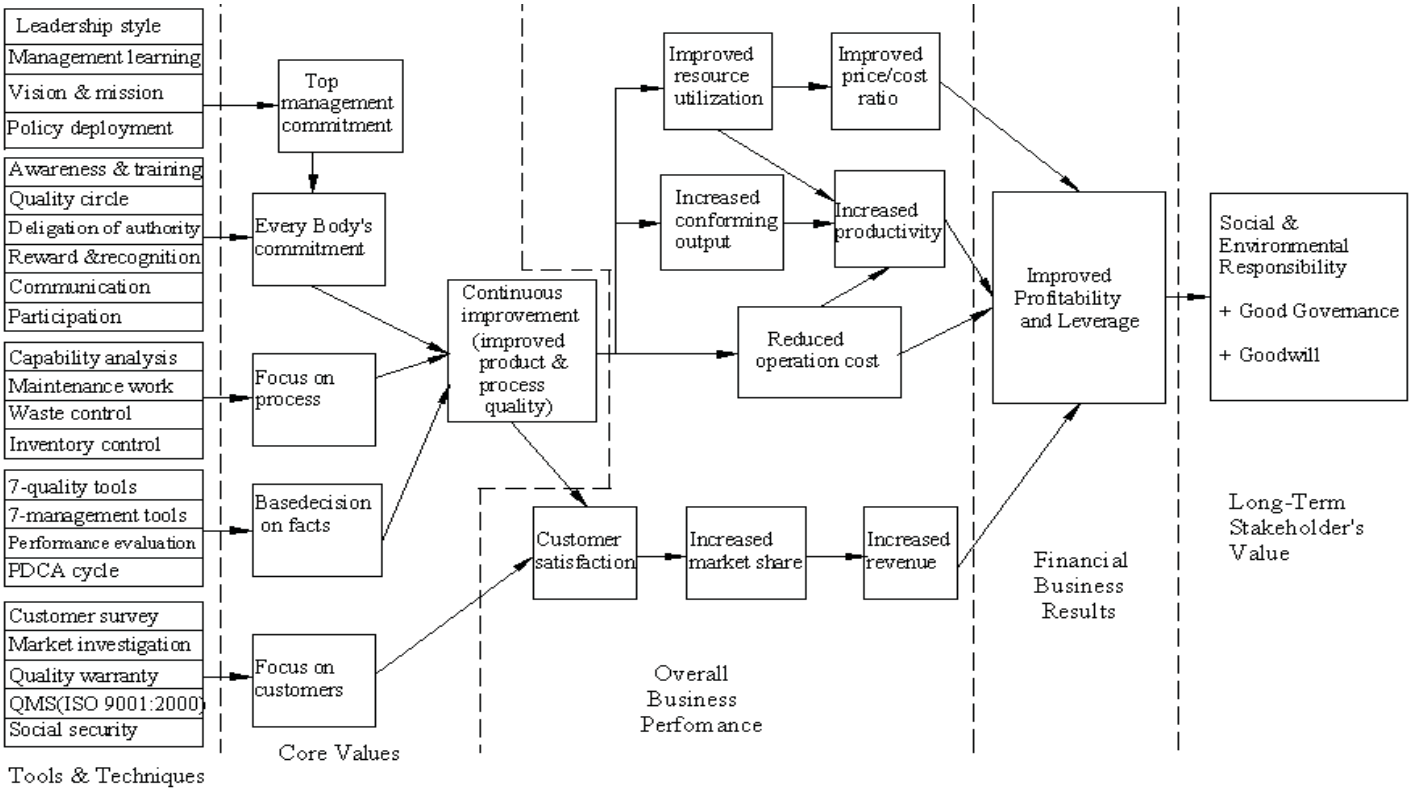

Figure 9. Proposed Business Improvement Model

Annexes: Survey Questionnaire in Meta Abo Brewery S.C.

Annex A: Crosby's Quality Management Maturity Matrix.

Rater's Department/Section _____Current Position_____

For each five of quality dimensions, please provide your opinion on one of the five-stages that best describes current status of your company and tick (x) mark on corresponding¸ symbol.

No	Quality Dimensions	Stage1 Uncertainty	Stage II Awakening	Stage III Enlightenment	Stage IV Wisdom	Stage V Certainty
1	**Management Understanding & Attitude**	¸ No comprehension of quality as a management tool. Tend to blame quality department for "quality problems".	¸ Recognition that quality management may be of value but the management not willing to provide money or time to make it all happen.	¸ While going through quality improvement program, they learn more about quality management; becoming supportive & helpful.	¸ Participating and understanding absolutes of quality management. Recognize their personal role in continuing emphasis.	¸ Consider quality management an essential part of company system.
2	**Quality Organization Status**	¸ Quality is hidden in manufacturing or engineering departments. Inspection probably not part of organization. Emphasis on appraisal & sorting.	¸ A strong quality leader is appointed but main emphasis is still on appraisal & moving the product. Still part of manufacturing or other.	¸ Quality department reports to top management, all appraisals that are incorporated & the manager has role in management of company.	¸ Quality manager is an officer of company, effective status reporting & preventive action. Involved with consumer affairs & special assignments.	¸ Quality manager on board of directors. Prevention is main concern. Quality is a thought leader.
3	**Problem Handling**	¸ Problems are fought as they occur; no resolution; inadequate definition; lots of yelling & accusation.	¸ Teams are set up to attack major problems. Long-range solutions are not sought.	¸ Corrective action communications are established. Problems are faced openly & resolved in an orderly way.	¸ Problems are identified early in their development. All functions are open to suggestion & improvement.	¸ Except in the most unusual cases, problems are prevented.
4	**Quality Improvement Action**	¸ No organized activities. No understanding of such activities.	¸ Trying obvious "motivational" short- term efforts	¸ Implementation of quality improvement tools & techniques with thorough understanding.	¸ Continuing quality improvement program and starting make certain.	¸ Quality improvement is a normal & continued activity.
5	**Summation of Company Position**	¸ "We do not know why we have problems with quality."	¸ "It is not absolutely a great deal why we have problems with quality."	¸ "Through management understanding of quality importance, we are trying to identify & resolve our problems."	¸ "Defect prevention is a routine part of operation."	¸ "We know why we don't have problems with quality."

ISSN 1833-3850 E-ISSN 1833-8119

Annex B

Using the following Simplified Business Excellence Model, please provide your opinion on one of the five scores that best describes the current status of your company and tick (x) mark on corresponding ¸ symbol.

No	**TQM Criteria**	**Standard Score**				
		I	II	III	IV	V
1	Leadership (10%)	¸ Management acts as individuals in taking and communicating decisions. They promote the need to develop and improve the firm & to set targets.	¸ Management acts as a team, ensure two-way open communication, become involved in improvement groups. They agree plans & set priorities.	¸ Managers develop and support improvement teams and make time available for them to work. They check the progress & recognize involvement, then they say "thank you".	¸ Managers are willing to "let go" and empower people to become involved in improvement teams between departments and with customers &suppliers.	¸ All managers are active inside & outside the company in promoting improvement activity. Continuous improvement is the culture & business philosophy.
2	Policy & Strategy (8%)	¸ Partial business plans exist-concentrating only on financial targets. Plans are not widely communicated or visibly championed by top management teams.	¸ Business plans encompass data on competition like-customer satisfaction measures. Key points are communicated, individuals understand & accept responsibility.	¸ Strategic directions like vision, mission, objectives, etc are communicated to all stakeholders. A new culture is being developed. Resources are made available for continuous improvement.	¸ Strategic direction is under-stood by all stakeholders. Key success indicators like meeting customers' needs are reviewed at all levels in the company.	¸ Strategic direction is visibly achieved. People's success recognized by leaders at all levels. Innovation & continuous improvements is the culture and business philosophy.
3	People Management (9%)	¸ Training is considered as a cost and people are employed to do a job.	¸ The management team recognizes that success comes from employees. Skill training is encouraged & training plans are agreed & aligned to the company's goals.	¸ Delegation of responsibility to people at appropriate level takes place. Appraisal schemes match the aspirations of the people & the company.	¸ Employees are allowed to implement improvement activity without reference to management. A climate is conductive to personal development & continuous improvement exists.	¸ Staff morale is high and exceeds the competitive benchmark. The full potential of all people is being realized to achieve the strategic direction.
4	Resources (9%)	¸ Resource management tends to be directed solely at financial areas. Decision on stock & materials are taken using hunches and "gut" feeling. Information is kept in people's heads.	¸ Information available- often talked about or over- analyzed but rarely used to improve. Cash & working capital are seen by all to be important. Stock controls are in place.	¸ Decisions are made on the basis of information. Stock is related to customer needs. Process improvement and evaluation of new technology takes place.	¸ All areas of waste are measured & form part of the improvement plan. Data are gathered to form an accurate view of competitors & used in business planning.	¸ All the company's resources are deployed to meet agreed policies & strategies. Benchmarking against the "best in class" is a key improvement driver.
5	Processes (14%)	¸ Few procedures exist	¸ Procedures are have been	¸ Critical processes are	¸ Meeting customers' need is	¸ System ensures all stakeholders'

		apart from financial controls. Everyone does their best & fire fighting is the norm. Changes are made to fix problems as and when appropriate.	written & imposed. A bureaucratic system exists with little chance for improvement. System's purposes are clear to all staff.	owned and there is support to monitor & improve them. Ownership is assigned to management who review corrective actions, etc.	seen as the purpose of the system. Procedures and operating standards are owned by the operators, managers & suppliers. Processes are being controlled.	needs are met by existing & new products. Customers find it easy to do business. Continuous feedback causes improvement & innovation.
6	Customer Satisfaction (20%)	, Customer satisfaction considered only in terms of external complaints. Complaints are dealt with when they arise with little attempt to find or correct the cause.	, Customer satisfaction measures are available from surveys. These data are used to set performance standards & staffs have been trained in customer service.	, The need to meet agreed customers' needs is reflected within the core strategic plans. A customer care policy exists and is widely published.	, Continuous research exists to identify &meet individual customer's needs. This research is fully integrated into business planning, improvement & innovation processes.	, Customer commitment is being delivered by all processes & relationships. Improvement & innovation exceed customers' expectation.
7	People Satisfaction (9%)	, Disputes & grievance are resolved as and when they arise. Absenteeism &staff turnover are high. Morale at times is poor and management tends to concentrate on them.	, Peoples' views are sought through surveys. Staffs are consulted on improvement but grievances are dealt with by "personnel". Health and safety are treated seriously.	, Two-way internal discussions take place & some form of appraisal process is used for joint improvement. Communication & feedback on a broad range of issues take place.	, Business changes that may adversely affect staff are jointly worked out. Data are available to show that all employees feel responsible for both their jobs & their company.	, Benchmarking against competitors shows that employee satisfaction is high and has an improving trend. 360 degree appraisal is taken as the norm.
8	Impact on Society (6%)	, Environmental & social obligations are seen as costly and a threat to competitiveness . Damage limitation exercises are used to counter problems.	, Environmental & social requirements are dealt with to conform fully to legal requirements. Policy documents & internal standards have been written.	, Strategic quality planning incorporates environmental & social obligations. Responsibility is allocated to senior managers. Environmental audit takes place.	, Data show that company betters legal requirements. Encouragement is given for employees to become involved in supporting local community activities.	, Data are gathered and views are sought from local society and employees and results are set in business planning. Formal recognition of environmental performance has been received.
9	Business Results (15%)	, Financial results are available & some non-financial indicators are published. They are seen as management data by the majority of staffs.	, System exists to monitor & display financial and non-financial indicators. They are communicated to staff & improvement targets are indicated.	, Indicators are used to measure progress & output and then available for improvement teams. Trends are monitored& used to set targets. Suppliers' quality is measured.	, Benchmarking is used to compare results with industry and "best in class" trends. Difference between targets & results are always published and available to the stakeholders' request.	, The company's performance exceeds all external benchmarks. Continuous performance improvement is part of the firm's culture.

ISSN 1833-3850 E-ISSN 1833-8119